

Research Application Summary

Promoting corporate and community involvement in natural resource management through dissemination of research findings and participation in field investigations of mine pollution in Kasese, Western Uganda

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Abstract

In a field attachment to Kasese Cobalt Company Limited (KCCL), the communities of Kahendero and Hamukungu landing sites on Lake George shores were engaged in investigations of the impact of pollution and subsequent interventions by KCCL, a corporate body, on the health of Lake George ecosystem, part of Queen Elizabeth Conservation Area (QECA). This was done as a contribution to creating community environmental awareness, lack of which is an impediment to natural resources management. It involved studying changes in concentrations of copper metal in fish (*Oreochromis* spp.) tissue and lake sediment around the landing sites by engaging them in monthly sampling for three months. The investigation was not aimed at making a scientific case as the samples were statistically inadequate but was a strategy to disseminate findings of M.Sc. research which investigated the potential use of effluent from the KCCL constructed wetland for revegetating a bare pyrite trail in QECA, a catchment of Lake George. It aimed at raising environmental awareness, promoting natural resources management and conservation in the communities, and enhancing community and corporate engagement in prevention of the potential adverse impacts of industry on the environment and communities livelihoods. The attachment had a great impact on creating the importance of research and environment management among the communities through interactions, sharing of knowledge and experiences.

Key words: Community environmental awareness, Lake George, natural resources management, *Oreochromis* spp., Queen Elizabeth Conservation Area

Résumé

Dans un terrain attaché à la Compagnie sprl de « Kasese Cobalt » (KCCL), les communautés de Kahendero et de Hamukungu se trouvant sur les sites de débarquement sur les côtes du lac George ont été engagés dans les enquêtes sur

L'impact de la pollution et les interventions ultérieures par KCCL, personne morale, sur la santé de l'écosystème du lac George, faisant partie du Parc Reine Elizabeth (QECA). Ces activités ont été faites comme une contribution à la création de la sensibilisation sur l'environnement, le manque de ce qui est un considéré comme obstacle à la gestion des ressources naturelles. Il s'agissait d'étudier l'évolution des concentrations de métal de cuivre dans les tissus de poisson (*Oreochromis spp.*) et des sédiments lacustres autour des sites d'embarcation en les faisant participer à un échantillonnage mensuel pendant trois mois. L'enquête ne visait pas à faire un cas scientifique même si les échantillons étaient statistiquement insuffisants, mais était une stratégie visant à diffuser les résultats de recherche en Maîtrise de Science. Cette maîtrise a enquêté sur l'utilisation potentielle des effluents de la zone marécageuse construite par KCCL pour la valorisation de la végétation, un sentier de pyrite nu dans QECA, un bassin versant du lac George où l'on peut pêcher. Elle vise à accroître la sensibilisation à l'environnement, à la promotion de gestion des ressources naturelles et à la conservation dans les communautés et à renforcer la communauté et l'engagement des entreprises en matière de prévention des impacts négatifs potentiels de l'industrie sur l'environnement et les moyens de subsistance des communautés. Le terrain en question a eu un grand impact sur la création de l'importance de la recherche et de gestion de l'environnement au sein des communautés par le biais des interactions, de partage des connaissances et des expériences.

Mots clés: La sensibilisation de la Communauté sur l'environnement, Le lac George, la gestion des ressources naturelles, *Oreochromis spp.*, le Parc Reine Elizabeth

Background

Human activities including mining and agriculture if not carefully undertaken can cause serious damage to the environment upon which life on earth is sustained. This environmental damage is largely due to lack of awareness of the need to protect the environment, inadequate regulatory requirement, irresponsible actions, or inadequate technologies used. Unfortunately, some of the damages caused have adverse consequences leading to low productivity of ecosystems and low benefits derived from the use of such natural resources, whether soils, forests, protected areas or mineral resources. During the operation of the Kilembe Copper Mine a cobaltiferous stockpile was constructed, but began to erode after the closure of the mines in the early 1970's (Oryem-Origa *et al.*, 2007). The erosion of

the pyrite stockpile resulted in a large acid trail all the way to Lake George (a Ramsar site). The acid trail contaminated a large area of the *Queen Elizabeth Conservation Area (QECA)* resulting in death of most of the shallow-rooted vegetation. High metal concentrations in sediments of Lake George wetlands and concentrations of heavy metals were recorded in plant and fish tissues, signifying a threat to the ecosystem of *QECA* and Lake George (Lwanga *et al.*, 2003). Significant attempt to reverse the spread and effects of these metals on the environment especially with the establishment of the Kasese Cobalt Company Limited (KCCL) in 1992 has led to reduced heavy metal deposition into the park, vegetation, reduced acidity and regeneration (Osaliya, 2010; Osaliya *et al.*, 2011). These benefits are a result of the implementation of sound environmental protection in the use of natural resources and demonstrate that, responsible actions in the use of natural resources whether by individuals or industry enhances environmental quality. This particular community based attachment and investigations were aimed at disseminating these research findings to stakeholders in the area. These included the communities fishing in Lake George and those in KCCL and *QECA*.

Materials and Methods

The field studies involved the local communities in Kahendero and Hamukungu landing sites which are fishing communities on the shores of Lake George in sampling of lake sediments. This followed environmental education and aware workshop. It also involved the management and KCCL environmental staff. This enabled the local communities and industry (KCCL) to appreciate the benefits of protecting the environment when implementing all kinds of production activities.

Two sites for sampling of Lake sediments were set where River Nyamwamba discharges into the lake and another at Kahendero landing site, all at shallow locations of one meter deep (Lwanga *et al.*, 2003). With the participation of the communities, a composite sample of sediment was taken once for each of the months of October, November and December in 2011; and fish tissue (internal organs) of *Oreochromis* spp. obtained from fishermen from the landings sites was also taken, one sample, for each of the three months. Samples were handled and analyzed according to Lwanga *et al.* (2003) and standard methods (APHA, 2005). Results were compared with findings adapted from Lwanga *et al.* (2003).

The potential use of basic (pH above 7) and nutrient rich effluent from a constructed wetland in the phytoremediation of the degraded pyrite trail, based research findings, were presented to the communities, together with the outcome of the fish and sediment studies.

Research Application

Dissemination of research findings to KCCL, the QECA management, and the local community north of QECA and the Lake George fishing community. Community workshops generated discussions which sought to understand why environmental issues were neglected in the past but were now gaining interest and consideration and what community or individuals do if an economic agent such as a corporation degrades the environment. This suggests that the workshops created concern for the environment and generated a sense of responsibility. Comments drawn included concern for pollution of Lake George water which has prevented its use for drinking. One participant pointed out that “...for decades, we used to take this water for domestic purpose, but even the taste of water has changed, with some sourness and now we have resorted to other sources”. Though this pollution largely arose from the activities of the old Kilembe Copper Mine that ceased operations in the late 1970s, there was a general belief that the pollution was largely a result of the activities of KCCL. KCCL has a NEMA permit to discharge effluent into Lake George and residents explained that “where the water entered the lake through River Nyamwaba, there was evidence of burning of grass”. The fishermen, especially those dealing with hook lining reported that when down the water, their hooks rust and their bodies get rashes. Reports however show that activities of KCCL which include environmental monitoring have brought significant environmental improvement in the mine degraded environment. Despite KCCL having a community programme, the community did not fully understand the benefits that had accrued from their operations viz-a-viz the impacts of the old Kilembe Copper mine. Some mistrust existed even with external technocrats. For example, they stated that: “We see some fish, the liver has changed to about blue but the technicians say it's okay”.

Information dissemination proved important in mobilizing communities to sustainably use and manage their environment, demand accountability in environmental governance and build trust between communities, researchers and managing technocrats. For example, an emotionally charged resident in

Kehendero Landing Site (Parish) stated that: “People come here, do their research, but they go to their offices and do not give us feed back”.

Concentration of copper in the Lake George sediments and fish (*Oreochromis spp*). The concentration of copper in sediments at River Nyamwamba entrance and Kahendero landing site and fish (internal organs) from study and those computed from Lwanga *et al.* (2003) are summarized in Table 1. The results are indicative of a decline in the concentration of copper metal in sediment and fish (internal organs), probably because KCCL contained the pyrite stockpile which was the major source of metal contamination. Thus, the huge difference in the concentrations of metals in samples obtained with participation of the communities from those reported from Lwanga *et al.* (2003) was probably due to heavy deposition of less or non-polluted sediment accumulated over the years.

Table 1. Concentrations of copper metal in sediment and fish internal organs.

Month samples taken	Concentrations of Cu (ppm)				*Lwanga <i>et al.</i> (2003)
	October (n = 1)	November (n = 1)	December (n = 1)	Mean (n = 3)	
Fish (internal organs)	17.27	44.51	17.27	30.89 ± 15.73	97.5 ± 10
Nyamwamba entrance (sediments)	12.48	19.6	12.48	16.04 ± 4.11	270.4 ± 45.0
Kahendero landing site (sediments)	70.1	87.75	70.1	78.93 ± 10.19	-

*The figure for fish (internal organs) was read from a graph and may not be accurate. All figures in the column are averaged for *O. niloticus* and *O. leuosticus* examined separately by Lwanga *et al.* (2003).

Need for collaborative programme for the revegetation of the degraded pyrite trail. As a result of the field attachment, the KCCL community programme gained more interest in environment health. Other stakeholders also came on board and included: the World Wide Fund for Nature (WWF) Rwakinji Project, Department of Botany, Makerere University, Queen Elizabeth Conservation Area and the Environment and the Natural Resources Department, Kasese District Local Government Administration.

Stakeholders generally agreed on the need for restoration of the mine polluted site but expressed that financial resources required was a major constraint. However, they were committed to developing collaborative efforts in improving environment health.

Acknowledgement

The first author is grateful to RUFORUM for the Field Attachment Programme Award (FAPA) which funded this attachment; and Kasese Cobalt Company Limited for attachment.

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